(12) UK Patent Application (19) GB (11) 2 286 423 (13) A

(43) Date of A Publication 16.08.1995

(21) Application No 9502507.8

(22) Date of Filing 09.02.1995

(30) Priority Data
(31) 9402500.4 (32) 09.02.1994 (33) GB

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(51) INT CL[6]
E05B 45/00 , B60R 25/10

(52) UK CL (Edition N)
E2A AAA A115 A160 A190 A420 A554

(56) Documents Cited
GB 2246390 A EP 0202146 A1 EP 0006147 A1
US 3789382 A

(58) Field of Search
UK CL (Edition N) E2A AAA AAB AAD AAE AAF AAG
INT CL[6] E05B 45/00 , G08B 13/06 13/16

(54) SECURITY SYSTEM

(57) A security lock (50) includes a seismic detector 68 and/or a magnetic detector (66) to detect attempted forced entry, and is adapted to report alarm events to a remote monitoring station (106) via a cable network 104 connecting a number of such locks to a shared network driver (102), which is connected to the monitoring station by modem and telephone line. Each protected property is identified by a unique code. An alarm system incorporating a number of such locks may further include intruder and/or smoke detection means and/or a "panic button" (90, 92, 94) which may also send alarm signals to the monitoring station. The lock may also include sensors for detecting opening and closing of the door (70, 72), operation of the lock (74) and the direction of insertion of a key into the lock (98). The lock electronics are mounted on a printed circuit board (52) located within the lock casing (54).

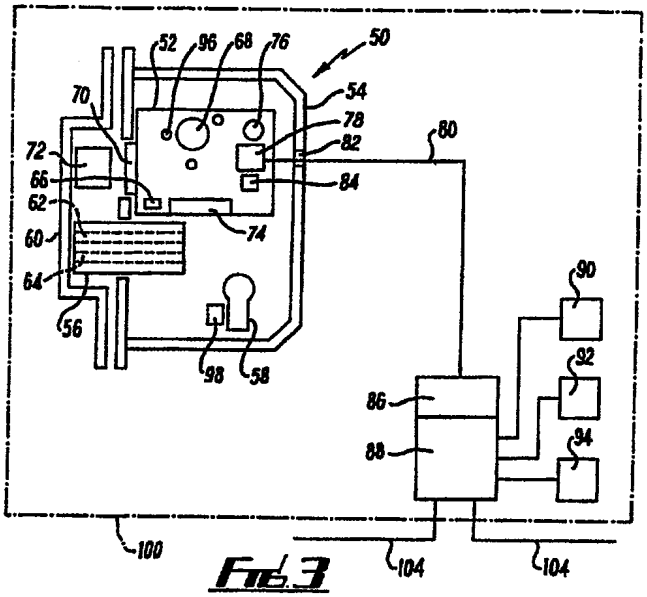

Fig.3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

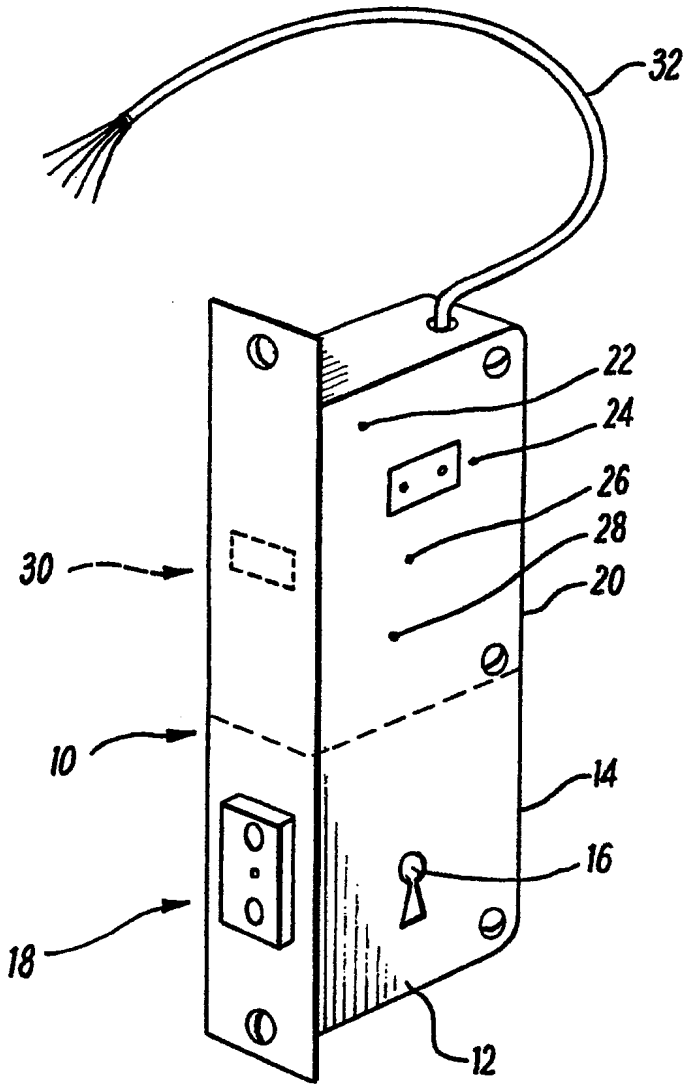

FIG. 1

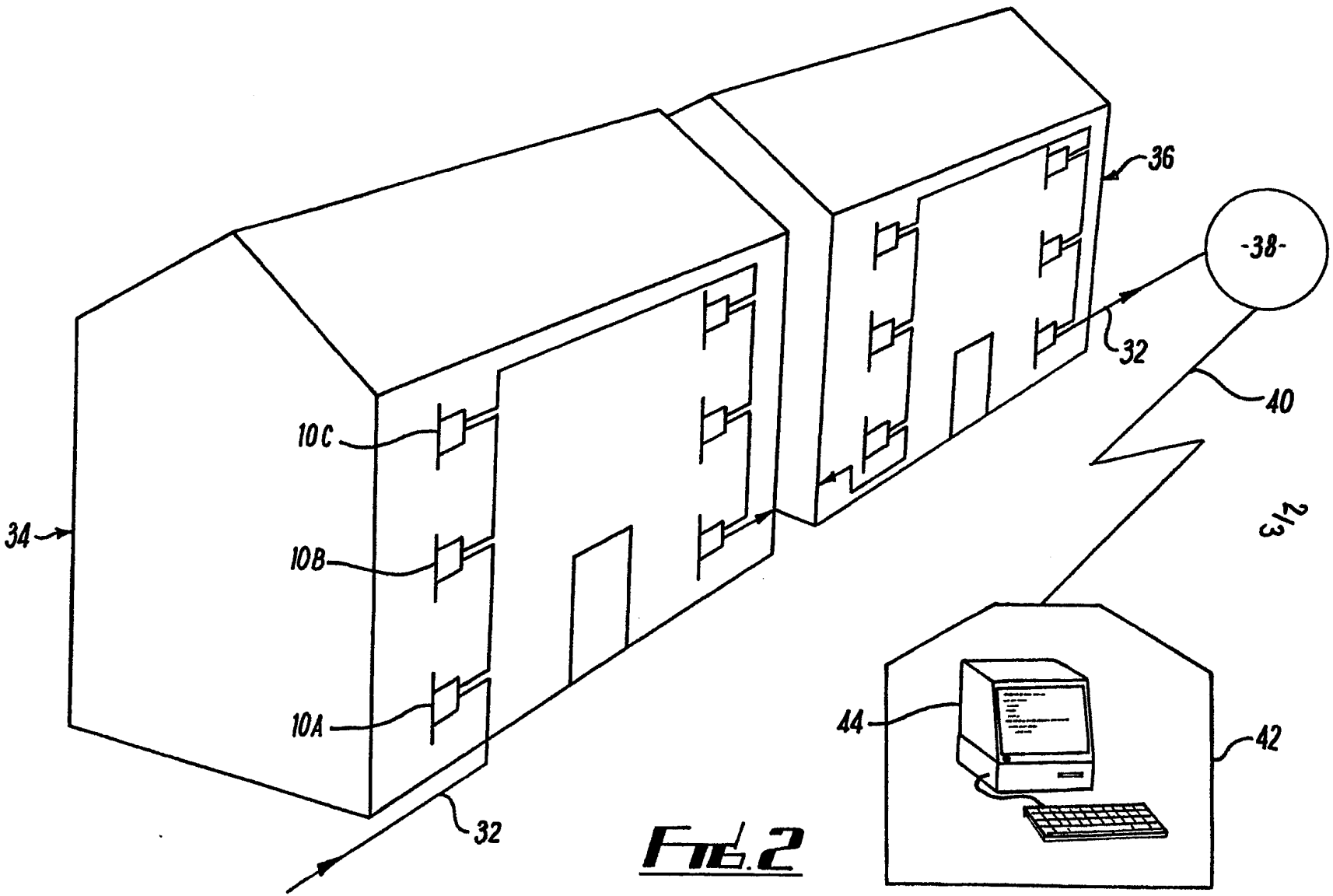

FIG. 2

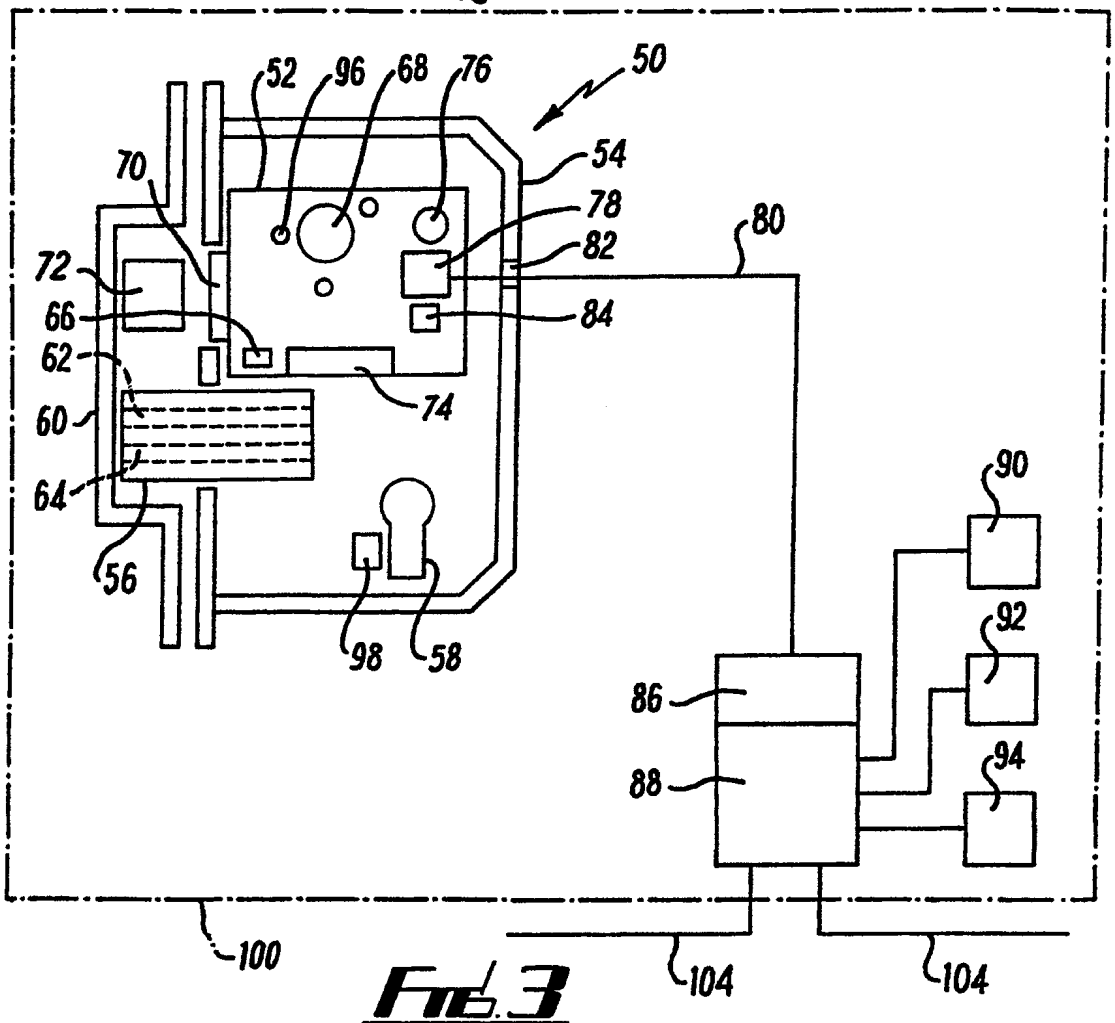
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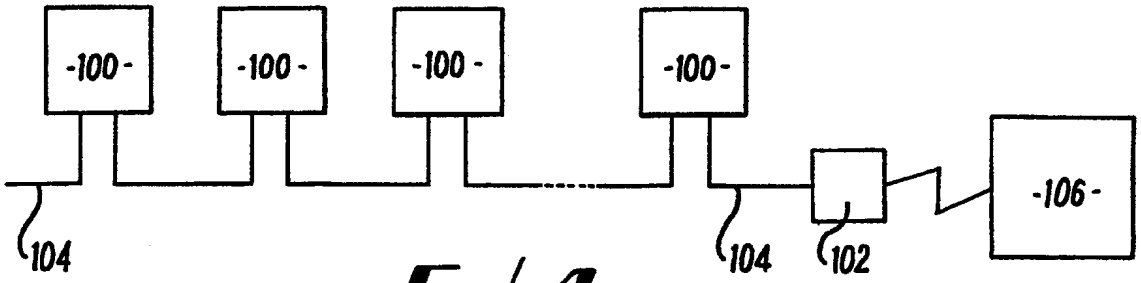
FIG. 3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102

FIG. 4

"Security System"

This invention relates to a security system, for example, a security lock on a door connected to a computer network.

It is known to provide a security system which sounds a distant alarm; conventional burglar alarm systems may sound an alarm at a remote control point at which several such systems are monitored; ie the systems are networked. However conventional security locks do not themselves detect forced entry, only the entry after the lock has been forced.

According to the invention a security lock comprises a locking means; means to detect an unauthorised attack on the door; and means to connect the lock to a remote monitoring station.

The means to detect an unauthorised attack on the door may be a seismic detector, which will detect gross vibration of the door, such as occurs when a potential intruder kicks in the door to force entry.

Alternatively, the means to detect an unauthorised attack on the door may comprise a magnetic detector associated with the deadlock mechanism of the lock, to detect forceable opening of the lock, for example by use of a jemmy.

Alternatively, both a seismic detector and a magnetic detector may be provided.

Optionally the seismic detector and a magnetic detector, when present, are situated within the casing of the lock.

Preferably the means to connect the lock to the remote monitoring station is situated within the door, eg between its panels, so that there are no external wires or other connectors which can be severed to disable the system.

Preferably each lock is provided with coding means so that the individual lock under attack can be identified at the remote monitoring station. Such a system is suitable for use on doors in blocks of flats or housing estates.

Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings in which:-

Figure 1 illustrates schematically a door lock according to the invention;

Figure 2 illustrates schematically the networking of a number of door locks according to the invention;

Figure 3 is a schematic sectional view of a preferred embodiment of a door lock in accordance with the invention, and associated system components; and

Figure 4 is a schematic representation showing the networking of a number of the locks of Figure 3.

In Figure 1, a door lock indicated generally by reference 10 comprises a housing 12 which contains a conventional mortice lock in its lower part 14, lockable through a keyhole 16. The deadlock 18 of the mortice lock is provided with a Hall effect device (not shown separately).

Above its lower part 14 is an upper part 20 which contains within it (but not shown separately) a seismic detector 22; an internal alarm control 24; an internal warning buzzer 26; and an internal addressable customer encoding module 28.

On the faceplate of the lock above the deadlock is an in-built door contact 30.

The housing contains appropriate electrical connections which pass out of the housing in a cable 32. The housing is set within a door in the conventional way, and the cable preferably passes through the door and doorframe, to avoid exposure of the electrical connections. The cable 32 is connected to a remote monitoring station, conveniently passing through ducts in walls or under floors.

There may also be provided a smoke detector also connected through the cable 32 to the monitoring

station.

Figure 2 shows a plurality of door locks 10A, 10B, 10C etc installed on doors to flats in two blocks of flats 34, 36. Cable 32 is connected through a connector 38 to a telephone or other line 40 and to a remote monitoring station 42 containing a computer 44.

In operation, the occupier of a flat locks the mortice lock when leaving the premises empty. The security system is then armed.

If an attempt is made to kick in the door, the seismic detector 22 senses the gross vibrations of the door, and sends an alarm signal through the cable 32, connector 32 and line 40 to the monitoring station 42. The customer encoding module 28 also sends a signal identifying the lock under attack to the monitoring station. It is an advantage of the invention that the warning can be given silently to the monitoring station.

If the lock is attacked with a jemmy, the magnetic field will be broken, because the Hall effect detector adjacent to the deadlock 18 is arranged to detect when the deadlock has been thrown into the keeper; preferably the arrangement is such that in normal opening with a key, the deadlock opens a very short time before the magnetic field is switched off; the short time may be a few milliseconds; by use of a truth table, an attack on the door can be distinguished from a legitimate opening.

If there is also provided a smoke detector connected through cable 32 to the monitoring station, warning of

fire can be given as well as of an attack on an identified door.

When the occupier is at home, it is preferable for safety reasons, eg rapid escape if there is a fire, not to lock the mortice lock, but clearly some element of security is required. This is provided by a small switch (not shown) on the side of the housing 12 facing into the flat; there is no keyhole on that side. The switch can be used to set the seismic detector 22.If the seismic detector operates, the internal buzzer sounds; this buzzer also sounds if the smoke alarm operates, and always sounds when the door opens, as detected by the contact 30. The occupant is thus protected and warned of an intruder when at home.

In addition, the internal alarm control 24 can be used as a panic button; if the occupier presses an associated button (not shown), an emergency help call is registered at the remote monitoring station 42, with the code identifying the lock, and therefore the address, from which the help call originated.

Preferably the computer 44 in monitoring station 42 operates in a polling mode, checking the integrity of all the locks connected to it. For example, 256 locks may be connected, each with an individual identifying code set on the customer encoding modules 28.

Figure 3 illustrates a preferred embodiment of the invention. The alarm control electronics and sensors of the lock 50 are all mounted on a double-sided printed circuit board (PCB) 52, designed to be enclosed within the upper half of the lock casing 54, above the conventional lock mechanism (not illustrated in

detail), which includes a deadbolt 56 and a keyhole 58. The deadbolt 56 engages a lock keeper 60 mounted on the door jamb, and has incorporated therein upper and lower hardened, anti-saw rollers 62, 64.

In this embodiment, the magnetic sensor to detect the use of a jemmy comprises a Hall-effect Schmitt-trigger device 66 located at the lower edge of the PCB adjacent the upper surface of the deadbolt 56. The lowermost roller 64 is magnetised, so that the use of a ferrous implement to force the lock will cause the magnetic field of the lowermost roller 64 to be coupled into the upper roller 62. This change is detected by the Hall effect sensor 66 to generate an alarm signal. The seismic detector in this case is a piezoelectric device 68 mounted on the PCB 52.

Opening and closing of the door is detected by a reed switch 70 mounted on an edge of the PCB 52 facing a magnet 72 located in the lock keeper 60 in a space above the deadbolt 56. This arrangement obviates the need for separate cabling to the door jamb. Operation of the lock 50 is detected by a switch 74, located beside the Hall effect sensor 66 on the lower edge of the PCB 52, which operates in response to movement of the deadbolt 56. An integral piezoelectric sounder 76 is also mounted on the PCB 52, and a connector block 78 allows connection to the external system, suitably via a six-conductor ribbon cable 80 which exits the casing 54 via a slot 82. The cable 80 may be connected to the rest of the system via a "contact hinge" fitted to the door, as an additional anti-tamper measure. The PCB 52 also includes a micro-switch 84 for setting up the alarm system.

The reverse side of the PCB 52 (not shown) carries conductors connecting the above mentioned components together with additional discrete surface-mount components and integrated circuits (not shown), including a Programmable Integrated Circuit (PIC) providing control logic for operation of the alarm system, including anti-false-alarm and can't-set functions.

The casing 50 of the lock typically includes hardened steel anti-drill plates, which protect the electronics as well as the mechanical lock mechanism itself.

The cable 80 is connected to a tenant-identification module (TIM) 86 located within the dwelling, which has a unique network address (suitably an eight-digit binary number set by a DIP-switch within the TIM 86). In this example, the TIM 86 forms part of a power supply unit (PSU) 88, suitably providing a 12V dc supply and including a sealed lead acid back-up battery. The PSU is powered from the dwelling's own power supply, but PSU's on the network can be interlinked so as to maintain power in each dwelling even if the power supply is turned off for extended periods (eg. if the dwelling is vacant). In a variation of the system, a number of individual dwellings could have their own TIM's connected to a shared PSU.

Each dwelling may also be provided with other sensors such as a smoke detector 90 and a passive infra-red detector (PIR) 92, together with a "panic" switch 94, which are all connected to the network via the TIM/PSU 86/88 and may be set simply by operation of the lock 50.

The seismic detector 68 is preferably of the multi-count, programmable type. The output signal from the seismic detector may be processed by the control logic to minimise false alarms. The set-up switch 84 is accessible through an opening (not shown) in the casing 54 and allows the lock to be switched to a set up mode in which the sensitivity of the detector 68 may be adjusted by means of a variable resistor 96, which is also accessible via a further opening (not shown). The sounder 76 may be employed in the set up mode to assist in setting the sensitivity by providing different audio signals (including different numbers of "pips" and different signal frequencies), in response to different levels and types of vibration (eg. multiple knocks within a particular period). In its normal operational mode, the system can also be adapted to produce different alarm conditions in response to different vibrations.

The set-up switch 84 might also be used to set further modes of operation, such as an "unoccupied" mode for use where a dwelling is vacant for an extended period of time. In this mode, the system may report every time the door is opened and closed, providing a log of access to the property.

The system electronics may also include an event log to record alarm events, which may yield useful information if there were multiple attempted break-ins at different dwellings on the network.

As noted in relation to the first embodiment, it is desirable that the system be set in differing modes depending upon whether the dwelling is occupied or not. In the first embodiment the lock has no keyhole on its

inner side, and the system is set in "occupied" mode by operation of a separate switch within the dwelling. In many cases, however, it will be desirable that the lock can be operated from inside the dwelling. In this case, different modes can be set by operation of the lock by detecting the direction from which the key is inserted in the keyhole. For this purpose, a suitable sensor 98 may be incorporated into the lock 50 to detect the direction of insertion of the key. This might be an optical or infra red transmitter and receiver, or other suitable sensor as will be apparent to those skilled in the art. If the lock is operated from outside, the system would typically be fully armed; if locked from the inside, only certain sensors and functions would be enabled.

The ability to detect the direction of entry of the key also provides the basis for detecting attempts to pick the lock; the system may be adapted to generate an alarm if an implement is inserted into the lock from "outside" and remains in the lock for a time greater than a predetermined period (eg 20 seconds).

The "panic" switch 94 can be used to send an alarm signal over the network regardless of whether the alarm system is enabled. The smoke detector 92 can be powered by the PSU 88, avoiding the problem of an internal battery failing or being removed.

Figure 4 illustrates the networking of a number of properties. The blocks 100 correspond to the apparatus located at each dwelling, as indicated by the dashed line in Figure 3. The individual units 100 are connected to each other and to a network driver 102 by means of a "data highway" 104. A 3-core data highway is

sufficient for the necessary power and data connections, but a standard 6-core cable is preferred to provide complete redundancy for all of the power and data circuits. The network driver is connected to the monitoring station 106 by a modem and standard PSTN telephone line.

The network driver 102 is the intelligent interface which collects information from each unit 100 on the circuit, and may be adapted from an industry standard data collector. It may be either analogue or digitally addressable. It acts as a dumb terminal and in this application need have no operator controls. However, local set-up commands can be carried out via an engineering keypad, or remotely from the monitoring station 106. Typically, the network driver might support up to 50 units 100 with four channels per TIM 86, and up to 2000m of data highway 104. It is not necessary to use screened cable. Typically, the network driver may be capable of logging up to 300 events with times and dates, and may include a serial input/output port for connection of a local printer.

The network driver communicates with the monitoring station 106 in the event of an alarm. The monitoring station 106 may be a personal computer equipped with modems. The monitoring station 106 may also download commands to the network driver 102, for example to operate relays at remote sites controlling lights, sounders, cameras or the like which might also be connected to the system. The network driver 102 can also report faults or damage in the network cabling to the monitoring station 106.

The system is arranged such that the alarms are set

simply by the operation of the lock when the tenant leaves the protected property. When the key is turned, the sounder 76 preferably operates for a period (suitably 10 seconds) prior to connecting to the network, whereafter the property is protected. If an alarm signal is detected during this period (eg from air turbulence affecting the PIR unit 90) then the sounder will switch to an intermittent tone (indicating "can't set") and the setting procedure is aborted.

Opening and relocking the door will initiate a second attempt to set the system and access the network. If repeated attempts to set the system fail, the sounder will sound for a longer period (eg 30 seconds) to indicate that there is a fault and that the system is not operational.

When the system is set from inside the property (whether by operation of a separate switch or by operation of the lock from inside), the sensors on the lock will be activated together with certain other system sensors; eg selected PIR units if there are multiple units in the property. In this case, certain alarm conditions may result only in the local sounder being activated, with no network alarm signal. This will minimise false alarms. Operation of the panic switch 94 or smoke detector will always result in a network alarm.

The lock might further include a microphone (not shown), which would allow activity within the property to be monitored in the event of an alarm. The microphone output would only be accessible when the lock had been operated from the outside.

It is a great advantage of a security system according to the invention that security can be provided economically to a large number of adjacent domestic dwellings. It is an advantage of a security lock according to the invention that the security system is not easily accessed, even when a door has been broken down. further, an alarm is given before the door is opened by an intruder.

Claims

1. A security lock comprising a locking means; means to detect an unauthorised attack on the door; and means to connect the lock to a remote monitoring station.

2. A security lock as claimed in Claim 1, wherein the means to detect an unauthorised attack on the door comprises a seismic detector.

3. A security lock as claimed in Claim 2, wherein said seismic detector is adapted for detecting gross vibration of the door.

4. A security lock as claimed in Claim 2 or Claim 3, wherein said seismic detector comprises a piezoelectric device.

5. A security lock as claimed in any preceding Claim 1, wherein the means to detect an unauthorised attack on the door includes a magnetic detector associated with the deadlock mechanism of the lock, to detect forceable opening of the lock, such as by use of a jemmy.

6. A security lock as claimed in Claim 5, wherein said magnetic detector comprises a Hall effect device.

7. A security lock as claimed in Claim 6, wherein the locking means includes a deadbolt having upper and lower hardened rollers, one of said rollers being magnetised, and said Hall effect device being located adjacent the non-magnetised roller.

8. A security lock as claimed in any preceding Claim,

further including means for detecting the opening and closing of a door in which the lock is mounted, in use.

9. A security lock as claimed in Claim 8, wherein said means for detecting the opening and closing of the door comprises a reed switch mounted to operate in response to the proximity of a magnet located in a keeper portion of the lock mounted on the door jamb, in use.

10. A security lock as claimed in any preceding Claim, further including means to detect operation of the lock.

11. A security lock as claimed in Claim 10, wherein said means to detect operation of the lock comprises a switch located adjacent a deadbolt forming part of the locking means.

12. A security lock as claimed in any preceding Claim, wherein the means to detect an unauthorised attack on the door, and other detection means where fitted, are situated within the casing of the lock.

13. A security lock as claimed in Claim 12, wherein said means to detect an unauthorised attack on the door, and said other detection means where fitted, are mounted on a printed circuit board located in an upper portion of said casing above the locking means.

14. A security lock as claimed in any preceding Claim, further including means to detect the direction in which a key is inserted into the lock.

15. A security lock as claimed in Claim 12, wherein

said means to detect the direction of insertion of the key comprises a sensor located adjacent the keyhole of the lock.

16. A security lock as claimed in any preceding Claim, further including an audio sounder device.

17. A security lock as claimed in any preceding Claim, wherein the means to connect the lock to the remote monitoring station is situated within the door so that there are no external wires or other connectors which can be severed to disable the system.

18. A security lock as claimed in any preceding Claim, wherein each lock is provided with associated coding means so that the individual lock under attack can be identified at the remote monitoring station.

19. A security lock as claimed in Claim 18, wherein said coding means is located in a unit separate from the lock, within the property to be protected by the lock.

20. An alarm system incorporating at least one security lock as claimed in any preceding Claim, in which each lock is connected, via coding means identifying each individual lock, to a remote monitoring centre.

21. An alarm system as claimed in Claim 20, wherein a number of locks are connected to a shared network driver unit, and said network driver unit is connected to said monitoring station.

22. An alarm system as claimed in Claim 20 or Claim

21, wherein each lock has an associated power supply unit.

23. An alarm system as claimed in Claim 20, Claim 21 or Claim 22, wherein each protected property is further provided with intruder detector means, and/or smoke detector means and/or an emergency call button, connected to said monitoring station.

24. An alarm system as claimed in Claim 23, in which the system can be set in different modes of operation depending upon whether or not individual protected properties are occupied.

25. A security lock substantially as hereinbefore described with reference to the accompanying drawings.

26. An alarm system substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) 17	Application number GB 9502507.8
Re. ant Technical Fields (i) UK Cl (Ed.N) E2A (AAA, -B, -D, -E, -F, -G) (ii) Int Cl (Ed.6) E05B 45/00; G08B 13/06, 13/16	Search Examiner A ANGELE Date of completion of Search 3 MAY 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- ALL

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	**P:**	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	**E:**	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	**&:**	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2246390 A	(SUNAMI)	1, 10, 12 14, 15, 17 at least
X	EP 0202146 A1	(FERCO)	1 to 3 at least
X	EP 0006147 A1	(HEILAND)	1 to 4, 11 to 13 at least
X	US 3789382 A	(WARREN) see whole document in each case	1, 5, 10 to 12, 19 20 at least

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